Apprenticeship and Industry Training

Automotive Service Technician

Apprenticeship Course Outline

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Alberta

Apprenticeship and Industry Training

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Automotive Service Technician
Table of Contents

Automotive Service Technician Table of Contents 1
Apprenticeship 2
Apprenticeship and Industry Training System 2
Apprenticeship Safety 4
Procedures for Recommending Revisions to the Course Outline 5
Apprenticeship Route toward Certification 6
Automotive Service Technician Training Profile 7

Course Outline

First Period Technical Training 13
Second Period Technical Training 20
Third Period Technical Training 27
Fourth Period Technical Training 33

Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding an employer. Employers hire apprentices, pay their wages and provide on-the-job training and work experience. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyperson or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution – usually a college or technical institute.

To become certified journeypersons, apprentices must learn theory and skills, and they must pass examinations. Requirements for certification—including the content and delivery of technical training—are developed and updated by the Alberta Apprenticeship and Industry Training Board on the recommendation of Automotive Service Technician Provincial Apprenticeship Committee.

The graduate of the Automotive Service Technician apprenticeship program is a certified journeyperson who will be able to:

- repair, maintain and overhaul or modify a motor vehicle
- comprehend work orders, technical bulletins and estimates, and relate the information to the job at hand
- interpret warranty policy in terms of service reports, component failures and analysis records
- perform assigned tasks in accordance with quality and production standards required by industry

After earning a journeyman certificate the Automotive Service Technician may opt to specialize in the repairing, rebuilding and servicing of any one or more of the many assemblies of the modern automobile.

Executive and supervisory opportunities in the automotive industry are frequently available to trained and certified mechanics with above average capabilities and motivation.

It is advantageous for the Automotive Service Technician to be familiar with the work experience of closely allied trades; eg. Heavy Equipment Technician, Auto Body Technician, Machinist and Welder Apprenticeship and Industry Training Committee Structure.

Apprenticeship and Industry Training System

Industry-Driven

Alberta's apprenticeship and industry training system is an industry-driven system that ensures a highly skilled, internationally competitive workforce in more than 50 designated trades and occupations. This workforce supports the economic progress of Alberta and its competitive role in the global market. Industry (employers and employees) establishes training and certification standards and provides direction to the system through an industry committee network and the Alberta Apprenticeship and Industry Training Board. The Alberta government provides the legislative framework and administrative support for the apprenticeship and industry training system.

Alberta Apprenticeship and Industry Training Board

The Alberta Apprenticeship and Industry Training Board provides a leadership role in developing Alberta's highly skilled and trained workforce. The board's primary responsibility is to establish the standards and requirements for training and certification in programs under the Apprenticeship and Industry Training Act. The board also provides advice to the Minister of Advanced Education on the needs of Alberta's labour market for skilled and trained workers, and the designation of trades and occupations.

The thirteen-member board consists of a chair, eight members representing trades and four members representing other industries. There are equal numbers of employer and employee representatives.

Industry Committee Network

Alberta's apprenticeship and industry training system relies on a network of industry committees, including local and provincial apprenticeship committees in the designated trades, and occupational committees in the designated occupations. The network also includes other committees such as provisional committees that are established before the designation of a new trade or occupation comes into effect. All trade committees are composed of equal numbers of employer and employee representatives. The industry committee network is the foundation of Alberta's apprenticeship and industry training system.

Local Apprenticeship Committees (LAC)

Wherever there is activity in a trade, the board can set up a local apprenticeship committee. The board appoints equal numbers of employee and employer representatives for terms of up to three years. The committee appoints a member as presiding officer. Local apprenticeship committees:

- monitor apprenticeship programs and the progress of apprentices in their trade, at the local level
- make recommendations to their trade's provincial apprenticeship committee (PAC) about apprenticeship and certification in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- make recommendations to the board about the appointment of members to their trade's PAC
- help settle certain kinds of disagreements between apprentices and their employers
- carry out functions assigned by their trade's PAC or the board

Provincial Apprenticeship Committees (PAC)

The board establishes a provincial apprenticeship committee for each trade. It appoints an equal number of employer and employee representatives, and, on the PAC's recommendation, a presiding officer - each for a maximum of two terms of up to three years. Most PACs have nine members but can have as many as twenty-one. Provincial apprenticeship committees:

- Make recommendations to the board about:
    - standards and requirements for training and certification in their trade
    - courses and examinations in their trade
    - apprenticeship and certification
    - designation of trades and occupations
    - regulations and orders under the Apprenticeship and Industry Training Act
- monitor the activities of local apprenticeship committees in their trade
- determine whether training of various kinds is equivalent to training provided in an apprenticeship program in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- consult with other committees under the Apprenticeship and Industry Training Act about apprenticeship programs, training and certification and facilitate cooperation between different trades and occupations
- consult with organizations, associations and people who have an interest in their trade and with employers and employees in their trade
- may participate in resolving certain disagreements between employers and employees
- carry out functions assigned by the board

Automotive Service Technician PAC Members at the Time of Publication

Mr. K. Alguire	Calgary	Presiding Officer
Mr. J. Roberts	Red Deer	Employer
Mr. R. Baas	Calgary	Employer
Mr. R. Schramm	Grande Prairie	Employer
Mr. W. Sjostrom	Edmonton	Employer
Mr. D. Smith	Brooks	Employer
Mr. B. Boutin	Edmonton	Employee
Mr. R. Bunz	Calgary	Employee
Mr. S. Klassen	Blackfalds	Employee
Mr. J. McDougall	Slave Lake	Employee

Alberta Government

Alberta Advanced Education works with industry, employer and employee organizations and technical training providers to:

- facilitate industry's development and maintenance of training and certification standards
- provide registration and counselling services to apprentices and employers
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Technical Institutes and Colleges

The technical institutes and colleges are key participants in Alberta's apprenticeship and industry training system. They work with the board, industry committees and Alberta Advanced Education to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship programs. They develop lesson plans from the course outlines established by industry and provide technical training to apprentices.

Apprenticeship Safety

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, employers, employees, apprentices and the public. Therefore, it is imperative that all parties are aware of circumstances that may lead to injury or harm.

Safe learning experiences and healthy environments can be created by controlling the variables and behaviours that may contribute to or cause an incident or injury. By practicing a safe and healthy attitude, everyone can enjoy the benefit of an incident and injury free environment.

Alberta Apprenticeship and Industry Training Board Safety Policy

The Alberta Apprenticeship and Industry Training Board (board) fully supports safe learning and working environments and emphasizes the importance of safety awareness and education throughout apprenticeship training- in both on-the-job training and technical training. The board also recognizes that safety awareness and education begins on the first day of on-the-job training and thereby is the initial and ongoing responsibility of the employer and the apprentice as required under workplace health and safety training. However the board encourages that safe workplace behaviour is modeled not only during on-the-job training but also during all aspects of technical training, in particular, shop or lab instruction. Therefore the board recognizes that safety awareness and training in apprenticeship technical training reinforces, but does not replace, employer safety training that is required under workplace health and safety legislation.

The board has established a policy with respect to safety awareness and training:

> **The board promotes and supports safe workplaces, which embody a culture of safety for all apprentices, employers and employees. Employer required safety training is the responsibility of the employer and the apprentice, as required under legislation other than the *Apprenticeship and Industry Training Act*.**

The board's complete document on its 'Apprenticeship Safety Training Policy' is available at www.tradesecrets.alberta.ca; access the website and conduct a search for 'safety training policy'.

Implementation of the policy includes three common safety learning outcomes and objectives for all trade course outlines. These common learning outcomes ensure that each course outline utilizes common language consistent with workplace health and safety terminology. Under the title of 'Standard Workplace Safety', this first section of each trade course outline enables the delivery of generic safety training; technical training providers will provide trade specific examples related to the content delivery of course outline safety training.

Workplace Health and Safety

A tradesperson is often exposed to more hazards than any other person in the work force and therefore should be familiar with and apply the Occupational Health and Safety Act, Regulations and Code when dealing with personal safety and the special safety rules that apply to all daily tasks.

Workplace Health and Safety (Alberta Employment and Immigration) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.worksafely.org

Technical Training

Apprenticeship technical training is delivered by the technical institutes and many colleges in the public post-secondary system throughout Alberta. The colleges and institutes are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All training providers place great emphasis on safe technical practices that complement safe workplace practices and help to develop a skilled, safe workforce.

The following institutions deliver Automotive Service Technician apprenticeship technical training:

Northern Alberta Institute of Technology (Main campus)
Medicine Hat College
Lethbridge College
Southern Alberta Institute of Technology (Main campus)
Grande Prairie Regional College (Fairview campus)
Lakeland College
Red Deer College

Procedures for Recommending Revisions to the Course Outline

Advanced Education has prepared this course outline in partnership with the Automotive Service Technician Provincial Apprenticeship Committee.

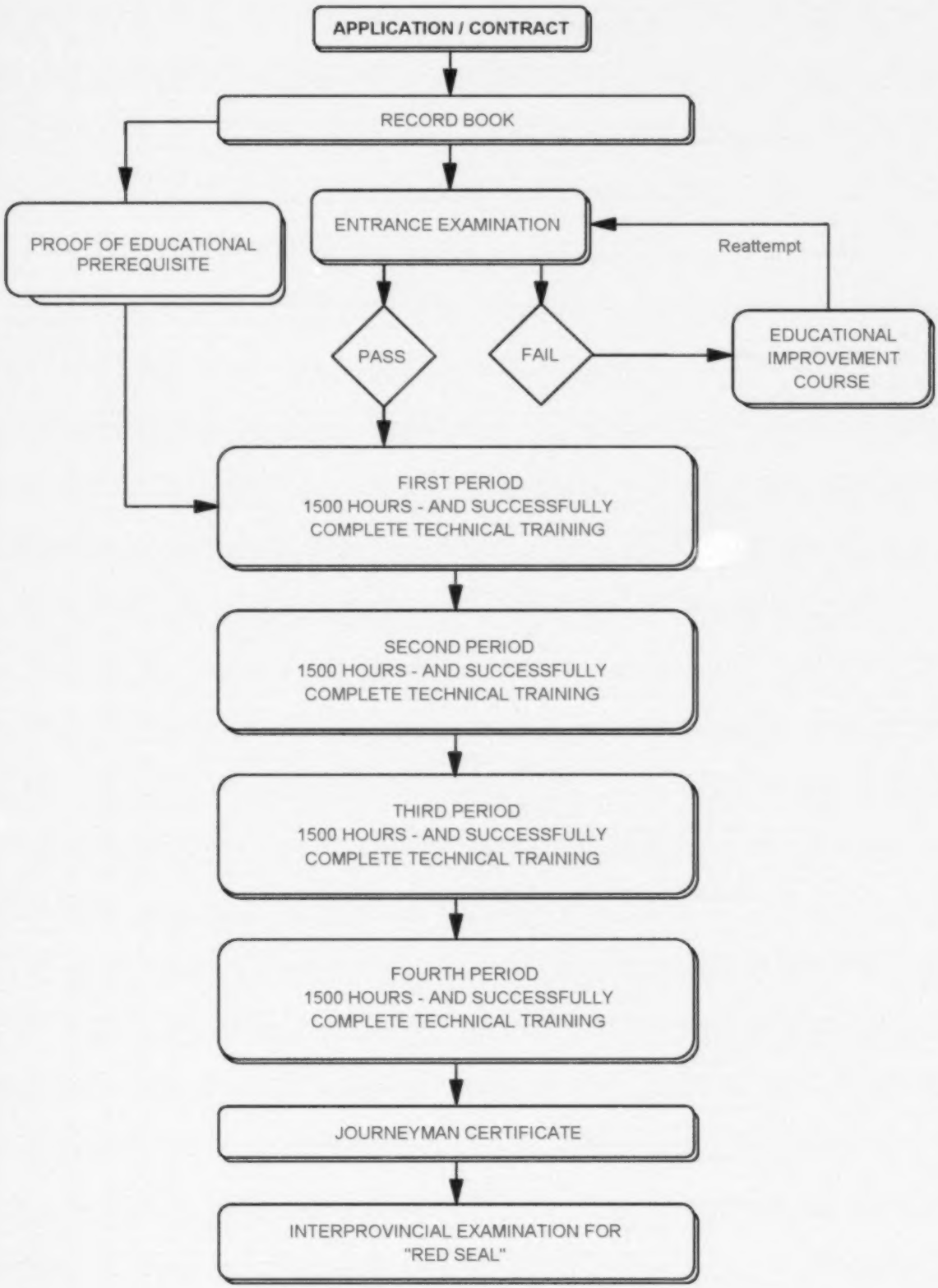
This course outline was approved on September 11, 2011 by the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. The valuable input provided by representatives of industry and the institutions that provide the technical training is acknowledged.

Any concerned individual or group in the province of Alberta may make recommendations for change by writing to:

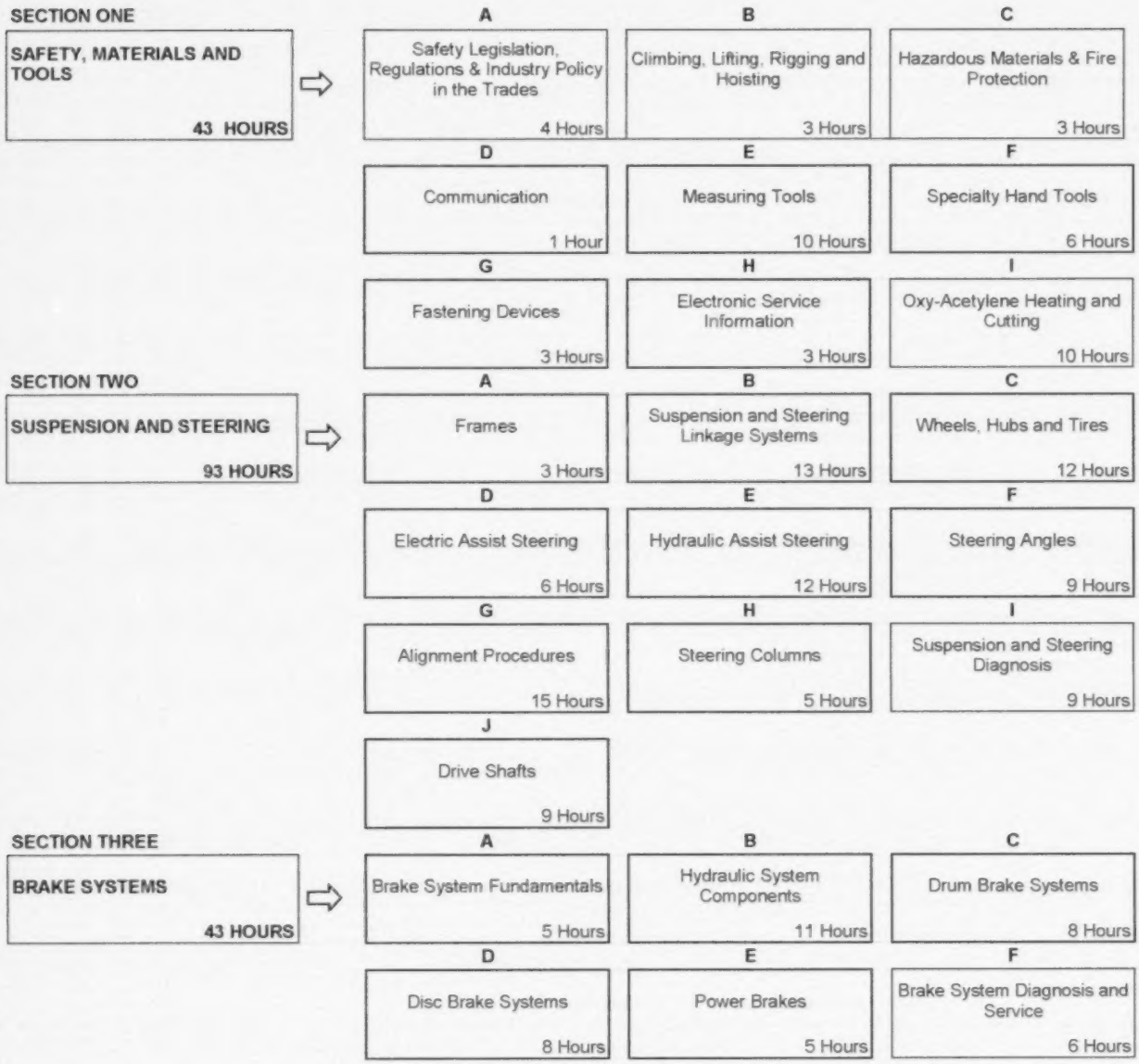
Automotive Service Technician Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
Advanced Education
10th floor, Commerce Place
10155 102 Street NW
Edmonton AB T5J 4L5

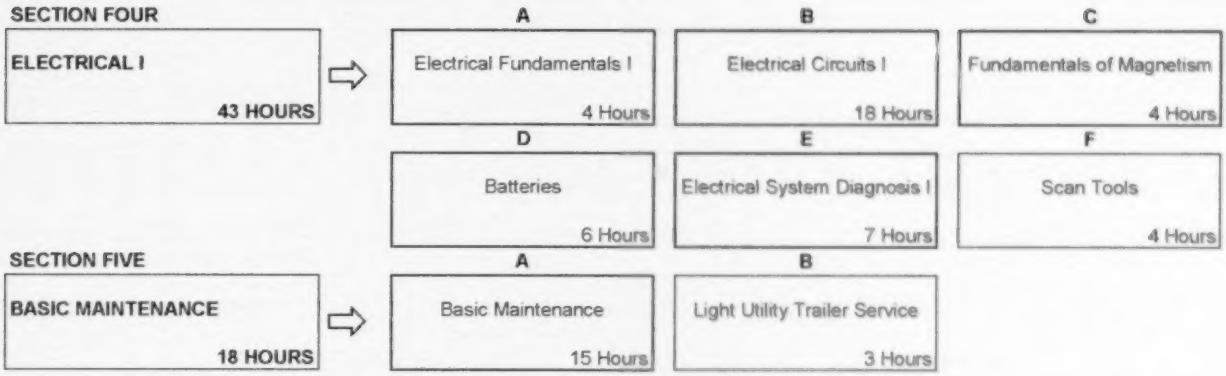
It is requested that recommendations for change refer to specific areas and state references used. Recommendations for change will be placed on the agenda for regular meetings of the Automotive Service Technician Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification



Automotive Service Technician Training Profile
First Period
(8 Weeks 30 Hours per Week – Total of 240 Hours)




SECTION FOUR
ELECTRICAL I
43 HOURS
A
Electrical Fundamentals I
4 Hours
B
Electrical Circuits I
18 Hours
C
Fundamentals of Magnetism
4 Hours
D
Batteries
6 Hours
E
Electrical System Diagnosis I
7 Hours
F
Scan Tools
4 Hours
SECTION FIVE
BASIC MAINTENANCE
18 HOURS
A
Basic Maintenance
15 Hours
B
Light Utility Trailer Service
3 Hours

Automotive Service Technician Training Profile
Second Period
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

ENGINES
100 HOURS

A	B	C
Engine Fundamentals 6 Hours	Blocks and Related Components 6 Hours	Crankshafts, Friction, Bearings and Related Components (Theory) 6 Hours
D	**E**	**F**
Crankshafts, Friction, Bearings and Related Components (Service) 3 Hours	Pistons, Piston Rings and Connecting Rods (Theory) 6 Hours	Pistons, Piston Rings and Connecting Rods (Service) 3 Hours
G	**H**	**I**
Camshafts and Valve Trains (Theory) 10 Hours	Camshafts and Valve Trains (Service) 6 Hours	Cylinder Head Assemblies (Theory) 6 Hours
J	**K**	**L**
Cylinder Head Assemblies (Service) 6 Hours	Engine Assembly and Disassembly Procedures 9 Hours	Air Induction Systems 4 Hours
M	**N**	**O**
Exhaust Systems 3 Hours	Lubrication Systems 6 Hours	Cooling Systems 8 Hours
P		
Engine Diagnosis 12 Hours		

SECTION TWO

MANUAL TRANSMISSIONS, TRANSAXLES & CLUTCHES
26 HOURS

A	B	C
Manual Transmission Fundamentals 8 Hours	Manual Transmissions 8 Hours	Manual Transaxles 4 Hours
D		
Clutches 6 Hours		

SECTION THREE

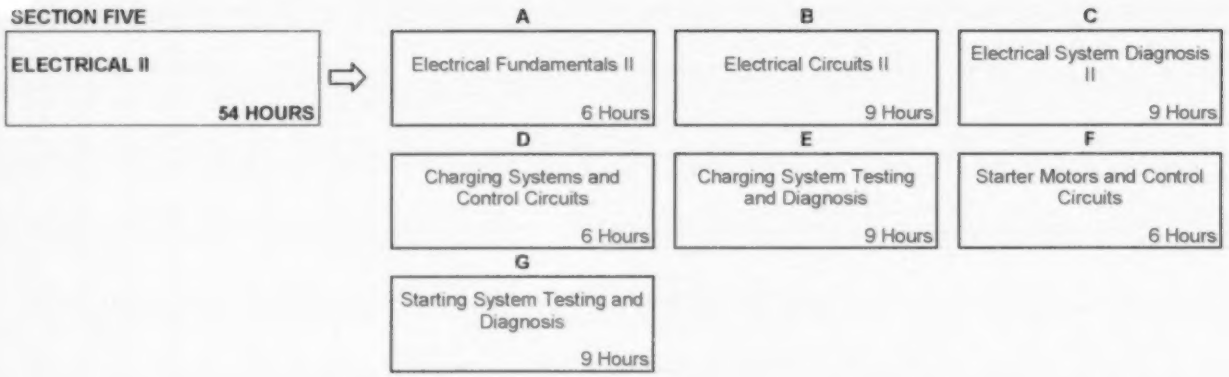
TRANSFER CASES
18 HOURS

A	B	C
Manual Transfer Cases 3 Hours	Electronic Transfer Cases 6 Hours	All Wheel Drive (AWD) Transfer Cases 6 Hours
D		
Four Wheel Drive (4WD) Axle Controls 3 Hours		

SECTION FOUR

DRIVE AXLE ASSEMBLIES
42 HOURS

A	B	C
Axles and Bearings 6 Hours	Differentials 9 Hours	Final Drive Gear Sets 4 Hours
D	**E**	
Final Drive Gear Set Assembly 8 Hours	Drive Axle Assembly Diagnosis and Service 15 Hours	


SECTION FIVE
ELECTRICAL II
54 HOURS
A
Electrical Fundamentals II
6 Hours
B
Electrical Circuits II
9 Hours
C
Electrical System Diagnosis II
9 Hours
D
Charging Systems and Control Circuits
6 Hours
E
Charging System Testing and Diagnosis
9 Hours
F
Starter Motors and Control Circuits
6 Hours
G
Starting System Testing and Diagnosis
9 Hours

Automotive Service Technician Training Profile
Third Period
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

ELECTRICAL III
63 HOURS

A	B	C
Electrical Fundamentals III 6 Hours	Control Module Inputs, Switches, and Sensors 18 Hours	Control Module Outputs and Output Devices 12 Hours
D	**E**	**F**
Control Modules 9 Hours	Multiplexing and Networking 6 Hours	Advanced Electrical Schematics 12 Hours

SECTION TWO

IGNITION SYSTEMS
33 HOURS

A	B	C
Ignition System Fundamentals 9 Hours	Electronic Ignition Systems 12 Hours	Ignition System Diagnosis and Service 12 Hours

SECTION THREE

FUEL SYSTEMS
57 HOURS

A	B	C
Fuel Properties 3 Hours	Combustion and Exhaust Emissions 4 Hours	Fuel Tanks and Supply Systems 8 Hours
D	**E**	**F**
Fuel Injection System Fundamentals 21 Hours	Fuel Injection System Diagnosis and Service 15 Hours	Alternate Fuel Systems 6 Hours

SECTION FOUR

EMISSION CONTROL SYSTEMS
14 HOURS

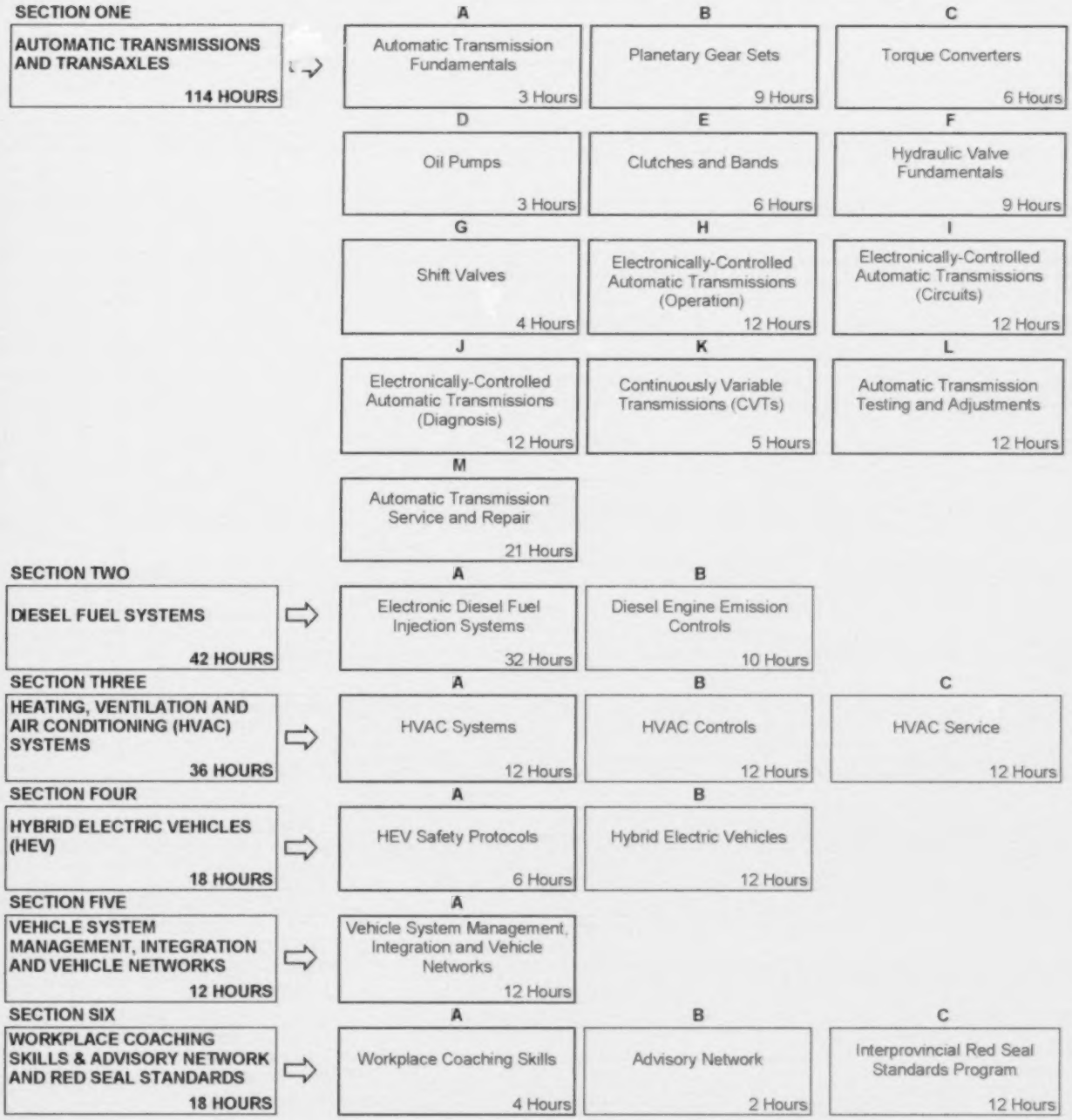
A	B	C
Exhaust Gas Recirculation Systems 3 Hours	Air Injection Systems 2 Hours	Catalytic Converter Systems 3 Hours
D		
Evaporative Emission Control Systems 6 Hours		

SECTION FIVE

ELECTRICAL SYSTEMS DIAGNOSIS
73 HOURS

A	B	C
Gauges and Warning Systems 6 Hours	Lighting Systems 9 Hours	Wiper and Washer Systems 8 Hours
D	**E**	**F**
Power Accessory Systems 7 Hours	Heated Systems 3 Hours	Speed Control Systems 3 Hours
G	**H**	**I**
Information and Entertainment Systems 7 Hours	Safety and Security Systems 6 Hours	Vehicle Networks 6 Hours
J	**K**	
Antilock Brake Systems 6 Hours	Passenger Restraint Systems 12 Hours	

Automotive Service Technician Training Profile
Fourth Period
(8 Weeks 30 Hours per Week – Total of 240 Hours)



NOTE: The hours stated are for guidance and should be adhered to as closely as possible. However, adjustments must be made for rate of apprentice learning, statutory holidays, registration and examinations for the training establishment and Apprenticeship and Industry Training.

FIRST PERIOD TECHNICAL TRAINING
AUTOMOTIVE SERVICE TECHNICIAN TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: ..... SAFETY, MATERIALS AND TOOLS ..... 43 HOURS

A. Safety Legislation, Regulations & Industry Policy in the Trades ..... 4 Hours

Outcome: Describe legislation, regulations and practices intended to ensure a safe work place in this trade.

1. Demonstrate the ability to apply the Occupational Health and Safety Act, Regulation and Code.
2. Explain the role of the employer and employee in regard to Occupational Health and Safety (OH&S) regulations, Worksite Hazardous Materials Information Systems (WHMIS), fire regulations, Workers Compensation Board regulations, and related advisory bodies and agencies.
3. Explain industry practices for hazard assessment and control procedures.
4. Describe the responsibilities of workers and employers to apply emergency procedures.
5. Describe positive tradesperson attitudes with respect to housekeeping, personal protective equipment and emergency procedures.
6. Describe the roles and responsibilities of employers and employees with respect to the selection and use of personal protective equipment (PPE).
7. Select, use and maintain appropriate PPE for worksite applications.

B. Climbing, Lifting, Rigging and Hoisting ..... 3 Hours

Outcome: Describe the use of personal protective equipment (PPE) and safe practices for climbing, lifting, rigging and hoisting in this trade.

1. Select, use and maintain specialized PPE for climbing, lifting and load moving equipment.
2. Describe manual lifting procedures using correct body mechanics.
3. Describe rigging hardware and the safety factor associated with each item.
4. Select the correct equipment for rigging typical loads.
5. Describe hoisting and load moving procedures.

C. Hazardous Materials & Fire Protection ..... 3 Hours

Outcome: Describe the safety practices for hazardous materials and fire protection in this trade.

1. Describe the roles, responsibilities features and practices related to the workplace hazardous materials information system (WHMIS) program.
2. Describe the three key elements of WHMIS.
3. Describe handling, storing and transporting procedures when dealing with hazardous material.
4. Describe safe venting procedures when working with hazardous materials.
5. Describe fire hazards, classes, procedures and equipment related to fire protection.

D. Communication ..... 1 Hour

Outcome: Communicate with customers and related trades people using industry standard terms and units for parts and operations.

1. Name standard terms and units of measure for components and operations.
2. Effectively communicate trade related information with customers and other trades people.

E. Measuring Tools ..... 10 Hours

Outcome: Measure components using tools common to the trade.

1. Convert numbers between decimals and fractions.
2. Perform linear measurements in imperial units.
3. Perform linear measurements in SI units.
4. Use and care for measuring tools.
5. Perform torque measurements in imperial and SI units.

F. Specialty Hand Tools ..... 6 Hours

Outcome: Use specialty hand tools common to the trade.

1. Perform double lap and SI tube flaring.
2. Use drills, taps and dies.
3. Demonstrate thread repair and broken fastener removal.

G. Fastening Devices ..... 3 Hours

Outcome: Assemble components using fasteners, adhesives and sealers common to the trade.

1. Demonstrate fastening and torquing procedures using threaded fasteners.
2. Describe the use of other retaining devices (e.g. snap rings, set screws).
3. Use sealers and adhesives common to the trade.
4. Describe tools and procedures used for plastic trim fasteners.

H. Electronic Service Information ..... 3 Hours

Outcome: Use electronic service information from various sources when diagnosing, servicing or repairing vehicles.

1. Use electronic service information to diagnose service or repair vehicles.
2. Access vehicle repair forums for diagnostic purposes.

I. Oxyacetylene Heating and Cutting ..... 10 Hours

Outcome: Perform metal cutting and heating operations using oxyacetylene equipment.

1. Describe the characteristics of and handling procedures for oxygen and acetylene.
2. Demonstrate handling procedures for regulators and hoses.
3. Demonstrate the use, care and maintenance of torches and tips.
4. Perform basic cutting operations.
5. Use personal protective equipment when heating or cutting.

SECTION TWO: ..... SUSPENSION AND STEERING ..... 93 HOURS

A. Frames ..... 3 Hours

Outcome: Identify automotive frame damage.

1. Identify frame damage using knowledge of frame construction and design features.
2. Perform frame checking procedures.

B. Suspension and Steering Linkage Systems ..... 13 Hours

Outcome: Describe components and operation of suspension and steering systems.

1. Describe the construction and design features of common suspension systems.
2. Describe the operating principles of suspension systems.
3. Identify steering linkage types and explain their operation.

C. Wheels, Hubs and Tires ..... 12 Hours

Outcome: Diagnose and service wheels, tires and wheel bearings.

1. Describe the construction, sizing, rating and design features of tires and wheels.
2. Describe the construction and application of wheel bearings.
3. Diagnose problems related to wheels, tires and wheel bearings.
4. Service wheels and tires.
5. Service wheel bearings.
6. Describe the purpose and operation of tire pressure monitoring systems (TPMS).
7. Diagnose and service TPMS systems.

D. Electric Assist Steering ..... 6 Hours

Outcome: Diagnose and repair electrically-assisted steering gear.

1. Describe the construction and operation of a manual steering rack and pinion assembly.
2. Describe the operation of an electrically-assisted rack and pinion steering system.
3. Diagnose and repair mechanical problems related to electrically-assisted steering gears.

E. Hydraulic Assist Steering ..... 12 Hours

Outcome: Diagnose and repair hydraulic assist steering systems.

1. Describe the construction and design of hydraulic assist steering gears.
2. Identify hydraulic assist pump types and explain their operation.
3. Describe the operation of hydraulic assist steering systems.
4. Diagnose, repair and adjust hydraulic assist non-rack and pinion steering gears.
5. Diagnose and repair hydraulic assist rack and pinion steering gears.
6. Diagnose hydraulic assist steering problems.

F. Steering Angles ..... 9 Hours

Outcome: Describe steering angles and how each affects vehicle handling.

1. Describe the function and effect of caster on vehicle operation.
2. Describe the function and effect of camber on vehicle operation.
3. Describe the function and effect of steering axis inclination on vehicle operation.
4. Describe the function and effect of toe on vehicle operation.
5. Describe the effect of thrust angle on vehicle operation.
6. Describe the measurement procedures for each steering angle.
7. Describe the adjustment procedures for each steering angle.

G. Alignment Procedures ..... 15 Hours

Outcome: Perform a wheel alignment.

1. Select the appropriate alignment settings within specifications for a given vehicle and load.
2. Perform a pre-alignment inspection and identify faulty components.
3. Perform a wheel alignment to adjust primary alignment angles.
4. Adjust steering linkage to establish the toe setting and center the steering wheel.
5. Describe a road test procedure to verify alignment or alignment problems.

H. Steering Columns ..... 5 Hours

Outcome: Diagnose and repair steering columns and related safety devices.

1. Describe the construction and operation of steering columns and related safety features.
2. Describe the process to disarm, remove, install and re-arm a steering column air bag.
3. Diagnose and repair steering columns and related safety devices.

I. Suspension and Steering Diagnosis ..... 9 Hours

Outcome: Diagnose and repair suspension systems and steering linkages.

1. Describe the diagnosis of suspension and steering problem(s).
2. Diagnose problem(s) related to suspension systems.
3. Diagnose problem(s) related to steering systems.
4. Choose an appropriate repair method to correct suspension or steering problem(s).
5. Service suspension and steering systems to correct problem(s).

J. Drive Shafts ..... 9 Hours

Outcome: Diagnose and repair drive shafts, universal joints and constant velocity joints.

1. Describe the construction and operation of drive shaft components.
2. Service and repair drive shaft assemblies.
3. Service and repair universal and constant velocity joints.
4. Diagnose and repair drive shaft vibration problems.

SECTION THREE: ..... BRAKE SYSTEMS .....43 HOURS

A. Brake System Fundamentals ..... 5 Hours

Outcome: Describe brake system principles and operation.

1. Describe the operating principles of brake systems with emphasis on hydraulic forces and friction.
2. Choose the correct brake fluid for an application based on the purpose, function, and characteristics of brake fluids.
3. State Pascal's Law and its implications for brake systems.

B. Hydraulic System Components ..... 11 Hours

Outcome: Diagnose and repair brake system hydraulic components.

1. Describe the operating principles, construction and design features of brake master cylinders.
2. Describe the operating principles, construction and design features of wheel cylinders and calipers used in brake systems.
3. Describe the construction and design features of brake hoses and lines.
4. Describe the purpose and operation of the metering, proportioning and pressure differential valves.
5. Describe the operation of the hydraulic components when used as a system.
6. Diagnose service, adjust and repair brake system hydraulic components.

C. Drum Brake Systems ..... 8 Hours

Outcome: Diagnose and repair drum brake systems.

1. Describe the construction, design features and operation of drum brake system components.
2. Service, adjust and repair drum brake systems.
3. Describe the construction and design features of drum type parking brake systems.
4. Service, adjust and repair drum type park brake systems.

D. Disc Brake Systems ..... 8 Hours

Outcome: Diagnose and repair disc brake systems.

1. Describe the construction, operation and design features of disc brake system components.
2. Service and repair disc brake systems.
3. Describe the construction and operation of disc type parking brake systems.
4. Service, adjust and repair disc type park brake systems.

E. Power Brakes ..... 5 Hours

Outcome: Diagnose and repair power brakes.

1. Describe the operation of a vacuum operated power brake unit.
2. Describe the operation of hydraulically operated power brake units.
3. Demonstrate the procedures for testing a power brake unit.

4. Diagnose problems related to and repair a power brake unit.
5. Describe safety precautions needed when working on hybrid vehicle braking systems.

F. Brake System Diagnosis and Service ..... 6 Hours

Outcome: Diagnose and service brake systems.

1. Demonstrate flushing and bleeding procedures on brake systems.
2. Demonstrate a bleeding procedure for an ABS brake system.
3. Diagnose problems related to brake systems.

SECTION FOUR: .....ELECTRICAL I.....43 HOURS

A. Electrical Fundamentals I..... 4 Hours

Outcome: Explain basic electrical principles.

1. Describe the physical qualities of insulators, conductors and semi-conductors.
2. Describe the physical qualities and units of measure used for electromotive force, current, resistance and power.

B. Electrical Circuits I..... 18 Hours

Outcome: Perform electrical circuit measurements.

1. Use electrical symbols and basic schematics.
2. Identify the three basic circuit types and their basic electrical properties.
3. Identify and explain an open, short or grounded circuit.
4. Using Ohm's Law, calculate for any of its variables when two are known.
5. Apply Ohm's Law to a circuit to calculate voltage, current and resistance.
6. Calculate power and explain the implications of power requirements in circuit design.
7. Perform voltage drop measurements using a voltmeter.
8. Perform parasitic drain and current draw tests using an ammeter.
9. Measure electrical resistance using an ohmmeter.
10. Service electrical circuit protection devices.

C. Fundamentals of Magnetism ..... 4 Hours

Outcome: Explain the principles of magnetism.

1. Describe magnetism and electromagnetism, and their properties.
2. Describe the construction and operation of electromagnetic coils.
3. Describe how magnetism or electromagnetism can change electrical energy into mechanical energy.
4. Describe how magnetism or electromagnetism can change mechanical energy into electrical energy.

D. Batteries ..... 6 Hours

Outcome: Diagnose and service batteries.

1. Describe the purpose, construction, operation and ratings of batteries.
2. Test and service batteries.
3. Diagnose problems related to batteries.
4. Perform battery charging and boosting operations.

E. Electrical System Diagnosis I ..... 7 Hours

Outcome: Diagnose and repair simple electrical circuits.

1. Use test equipment to test simple circuits and interpret results.
2. Perform simple wire and connector repairs.
3. Understand the hazards associated with electrostatic discharge (ESD) when working on vehicle electronic systems.

F. Scan Tools ..... 4 Hours

Outcome: Use generic, manufacturer-specific or laptop-based scan tools and software.

1. Use scan tools to retrieve diagnostic trouble codes and data, clear codes, reset warning systems and perform function tests.
2. Interpret scan data related to first period automotive systems.

SECTION FIVE: ..... BASIC MAINTENANCE ..... 18 HOURS

A. Basic Maintenance ..... 15 Hours

Outcome: Describe basic maintenance routines for vehicles.

1. Identify and describe the functions and characteristics of engine oils, transmission fluids and gear oils.
2. Describe procedures for disposal of coolant, lubricants and filters.
3. Service engine air filters and cabin air filters, oil filters and fuel filters.
4. Describe safe and environmentally sensitive handling and storage practices for gasoline and diesel fuels.
5. Identify and describe the functions and characteristics of engine coolants.
6. Inspect, replace and adjust accessory drive belts.
7. Describe basic procedures for replacing lubricants and coolants.
8. Describe the purpose for maintenance schedules and reset maintenance minders.
9. Describe a maintenance inspection process.

B. Light Utility Trailer Service ..... 3 Hours

Outcome: Describe service procedures for light utility trailers.

1. Describe the operation of electric brakes on light utility trailers.
2. Describe the service procedures for electric brakes on light utility trailers.
3. Describe wheel bearing service procedures for light utility trailers.

SECOND PERIOD TECHNICAL TRAINING
AUTOMOTIVE SERVICE TECHNICIAN TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: ..... ENGINES ..... 100 HOURS

A. Engine Fundamentals ..... 6 Hours

Outcome: Describe the operation of internal combustion engines.

1. Identify and explain common engine classifications, terms and definitions.
2. Describe the principles of engine operation of four stroke cycle engines.
3. Compare physical and operational differences between engines that using different fuels.

B. Engine Blocks ..... 6 Hours

Outcome: Determine the serviceability of an engine block.

1. Describe the purpose, construction and design features of the block and related components.
2. Identify types of cylinder sleeves/liners and state their purpose.
3. Inspect and measure engine blocks.
4. Describe the service options to repair worn engine blocks.

C. Crankshafts, Friction Bearings and Related Components (Theory) ..... 6 Hours

Outcome: Describe crankshaft and friction bearing function, design and construction.

1. Describe the function, design features and operating principles of crankshafts.
2. Describe the function, characteristics and design features of friction bearings and explain how bearings are constructed.
3. Describe the function, design features and operating principles of balance shafts, auxiliary shafts, flywheels and harmonic balancers.

D. Crankshafts, Friction Bearings and Related Components (Service) ..... 3 Hours

Outcome: Inspect and measure a crankshaft, friction bearings and related components.

1. Inspect and measure a crankshaft to determine service worthiness.
2. Describe service procedures for crankshafts, friction bearings, shafts, flywheels, and harmonic balancers.

E. Pistons, Piston Rings and Connecting Rods (Theory) ..... 6 Hours

Outcome: Describe the function of pistons and related components.

1. Describe the function, construction and design features of pistons and piston pins.
2. Describe the function, construction and design features of piston rings.
3. Describe the function, construction and design features of connecting rods.
4. Describe how pistons, piston rings and piston pins are lubricated.
5. Describe how piston mass and connecting rod balance are critical to engine balance.

F. Pistons, Piston Rings and Connecting Rods (Service) ..... 3 Hours

Outcome: Inspect and measure pistons and related components.

1. Measure and inspect pistons, connecting rods, piston pins and rings to ensure correct fit.
2. Describe the service procedures for connecting rods.

G. Camshafts and Valve Trains (Theory) ..... 10 Hours

Outcome: Describe camshaft and valve train operation.

1. Describe the construction, design and functions of valve train components.
2. Describe different methods for metering lubricating oil in the valve train.
3. Describe the operation of drive mechanisms for timing camshafts.
4. Describe the operation of variable valve timing mechanisms.

H. Camshafts and Valve Trains (Service) ..... 6 Hours

Outcome: Diagnose camshafts and valve train components.

1. Measure, test and inspect camshafts and lifters.
2. Measure, test and inspect valve train drive mechanisms.
3. Measure, test and inspect rocker arms, push rods and other valve train components.
4. Diagnose and repair variable valve timing systems.

I. Cylinder Head Assemblies (Theory) ..... 6 Hours

Outcome: Describe the operation and function of cylinder head assemblies.

1. Describe the purpose of combustion chamber designs used in gasoline and/or diesel engines.
2. Describe the purpose, construction and design of cylinder heads.
3. Describe the purpose, function and design of valves, valve springs and associated hardware.
4. Describe the purpose, function and design of valve guides and valve seats.

J. Cylinder Head Assemblies (Service) ..... 6 Hours

Outcome: Inspect and measure cylinder heads and related components.

1. Inspect and measure cylinder heads, valves, valve guides, valve seats and valve springs.
2. Assemble a cylinder head.

K. Engine Disassembly and Assembly Procedures ..... 9 Hours

Outcome: Disassemble and assemble engines and attached components.

1. Disassemble an engine.
2. Assemble an engine.

L. Air Induction Systems ..... 4 Hours

Outcome: Diagnose and repair air induction systems and related components.

1. Identify the type of induction system used on an engine.
2. Describe the purpose and design features of intake manifolds.

3. Describe the parts, construction and operating principles of a turbo charger and supercharger.
4. Describe the maintenance requirements and service precautions for turbo chargers and superchargers.

M. Exhaust Systems ..... 3 Hours

Outcome: Diagnose and repair exhaust systems.

1. Describe the function and design of exhaust system components.
2. Describe exhaust system diagnostic procedures.
3. Describe exhaust component removal and replacement procedures.
4. Demonstrate engine exhaust gas venting procedures.

N. Lubrication Systems ..... 6 Hours

Outcome: Diagnose and repair lubricating systems.

1. Describe the operating principles of full flow lubrication systems and related components.
2. Diagnose and repair full flow lubrication systems.
3. Describe the purpose and operation of a positive crankcase ventilation (PCV) system.
4. Diagnose and service PVC systems.

O. Cooling Systems ..... 8 Hours

Outcome: Diagnose and repair cooling systems and related components.

1. Describe the physical principles involved in heat transfer.
2. Describe the purpose, construction and operation of cooling systems and related components.
3. Diagnose, and repair problems related to cooling systems and related components.

P. Engine Mechanical Diagnosis ..... 12 Hours

Outcome: Diagnose engine mechanical problems.

1. Diagnose common engine mechanical problems using engine test equipment.
2. Describe the importance of using the physical senses when diagnosing engine problems.

SECTION TWO: ..... MANUAL TRANSMISSIONS, TRANSAXLES AND CLUTCHES ..... 26 HOURS

A. Manual Transmission Fundamentals ..... 8 Hours

Outcome: Describe the operating principles of a manual transmission.

1. Describe the operating principles of a manual transmission.
2. Trace the path of power through a manual transmission or transaxle in all gear ranges.
3. Identify gear designs and calculate gear ratios and torque multiplication.
4. State the lubricating requirements for a manual transmission or transaxle and explain how their internal components are lubricated.
5. Describe the operation of synchromesh units.
6. Describe the purpose and operation of shift mechanisms.
7. Identify types of bearings and seals in manual transmissions and transaxles.

B. Manual Transmissions ..... 8 Hours

Outcome: Diagnose a manual transmission.

1. Describe the purpose, construction and operation of a manual transmission and its components.
2. Disassemble and reassemble a manual transmission using a shop manual.
3. Adjust manual transmission linkages.
4. Diagnose problems related to manual transmissions.

C. Manual Transaxles ..... 4 Hours

Outcome: Diagnose a manual transaxle.

1. Describe the purpose, construction and operation of a manual transaxle and its components.
2. Describe the disassembly and reassembly of a manual transaxle.
3. Describe the adjustment of manual transaxle linkages.
4. Diagnose problems related to manual transaxles.

D. Clutches ..... 6 Hours

Outcome: Diagnose and repair automotive clutches.

1. Describe the operating principles of a clutch.
2. Describe the construction, design features, and function of a clutch.
3. Describe the service and adjustment of a clutch assembly.
4. Diagnose problems related to a clutch assembly.

SECTION THREE: ..... TRANSFER CASES ..... 18 HOURS

A. Manual Transfer Cases ..... 3 Hours

Outcome: Diagnose manual transfer cases.

1. Describe the purpose and operation of a manual transfer case.
2. Diagnose manual transfer case problem(s).

B. Electronic Transfer Cases ..... 6 Hours

Outcome: Diagnose electronic transfer cases.

1. Describe the operations of electronic transfer cases.
2. Diagnose problems related to electronic transfer case shift controls.

C. All Wheel Drive (AWD) Transfer Cases ..... 6 Hours

Outcome: Diagnose AWD transfer cases.

1. Describe operations of AWD transfer cases and their components.
2. Diagnose problems related to AWD transfer cases.

D. Four Wheel Drive (4WD) Controls ..... 3 Hours

Outcome: Diagnose 4WD engagement controls.

1. Describe the purpose and operation of locking hubs and axles on four wheel drive axles.
2. Diagnose problems related to locking hubs and axles.

SECTION FOUR: ..... DRIVE AXLE ASSEMBLIES ..... 42 HOURS

A. Axles and Bearings ..... 6 Hours

Outcome: Service axle shafts and bearings.

1. Identify the common types of axle shafts by bearing types and locations.
2. Describe the function of major components of a drive axle assembly.
3. Describe how axle and wheel bearings are retained, adjusted and lubricated.

B. Differentials ..... 9 Hours

Outcome: Describe the operation of differentials.

1. Describe the purpose, construction and operation of standard differentials.
2. Describe the purpose, construction and operation of traction enhancing differentials.
3. Perform calculations to determine the influence of a differential on output torque and speeds.
4. Describe the lubrication requirements for differentials.

C. Final Drive Gear Sets ..... 4 Hours

Outcome: Describe the design and operation of final drive gear sets.

1. Describe the purpose, design features and operation of final drive gear sets.
2. Classify final drive gear sets by ratio, tooth design, number of drive pinion gear bearings and carrier types.
3. Calculate final drive gear ratios.
4. Trace the path of power from the drive pinion gear to the axle.
5. Describe how the final drive gear set support bearings are lubricated.

D. Final Drive Gear Set Assembly ..... 8 Hours

Outcome: Assemble a final drive gear set.

1. Identify an industry acceptable contact pattern for a hypoid type crown and drive pinion gear set.
2. Demonstrate the effect that moving the drive pinion or crown gears into or out of mesh has on the contact pattern.
3. Demonstrate the use of depth gauges and explain the concept of 'nominal depth'.
4. Perform calculations for shim selection when installing different types of drive pinion gears.

E. Drive Axle Assembly Diagnosis and Service ..... 15 Hours

Outcome: Diagnose and repair drive axle assemblies.

1. Diagnose problems related to drive axles.
2. Measure gear backlash, bearing preload and gear runout.
3. Interpret a hypoid type crown and pinion gear set contact pattern for diagnostic purposes.
4. Demonstrate procedure to test a traction-enhancing differential.
5. Diagnose problems related to and service all drive axle, differential case and drive pinion gear bearings and seals.

SECTION FIVE: ..... ELECTRICAL II ..... 54 HOURS

A. Electrical Fundamentals II ..... 6 Hours

Outcome: Use electrical terms, formulas and meters.

1. Calculate current, voltage and resistance in a circuit.
2. Use electrical test equipment to locate opens, shorts or grounds in an electrical circuit.

B. Electrical Circuits II ..... 9 Hours

Outcome: Determine electrical values in a circuit.

1. Interpret electrical circuit diagrams.
2. Perform measurements of current, voltage and resistance.

C. Electrical System Diagnosis II ..... 9 Hours

Outcome: Diagnose electrical systems.

1. Connect scan tools to vehicles and interpret scan data on applicable second period automotive systems.
2. Use diagnostic strategies to locate open, shorts and grounds in an automotive circuit.

D. Charging Systems and Control Circuits ..... 6 Hours

Outcome: Describe the operation of a charging system.

1. Describe the operating principles of a generator.
2. Describe the purpose, construction and operation of a vehicle charging system and its related components.
3. Describe the purpose and operation of electronic voltage regulators.
4. Describe the purpose, construction and operation of instrument panel charge indicator/warning devices.

E. Charging System Testing and Diagnosis ..... 9 Hours

Outcome: Diagnose charging systems.

1. Perform common diagnostic routines on charging systems and associated wiring.
2. Interpret results and diagnose problems from data obtained from charging system diagnostic tests.

F. Starter Motors and Control Circuits ..... 6 Hours

Outcome: Describe the operation of a starter motor.

1. Describe the operating principles of dc motors.
2. Describe the purpose, construction and operation of starter motors and related components.
3. Using wiring diagrams, describe the operation of starter motor electrical circuits.

G. Starting System Testing and Diagnosis ..... 9 Hours

Outcome: Diagnose starting systems.

1. Perform starter system diagnostic routines, interpret results and diagnose problems from the data obtained.
2. Use sounds heard during performance of the starter motor load test to aid in starter motor diagnosis.
3. Test starting system components and associated wiring.

THIRD PERIOD TECHNICAL TRAINING
AUTOMOTIVE SERVICE TECHNICIAN TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

IT IS EXPECTED THAT APPRENTICES WILL USE SCAN TOOLS, LAB SCOPES, LAPTOP SOFTWARE AND OTHER ADVANCED ELECTRONIC TEST EQUIPMENT IN THE DIAGNOSIS AND REPAIR OF VEHICLE SYSTEMS.

SECTION ONE: ..... ELECTRICAL III ..... 63 HOURS

A. Electrical Fundamentals III ..... 6 Hours

Outcome: Use electrical diagnostic aids and test procedures.

1. Interpret electrical circuit diagrams.
2. Use electrical test equipment to identify and locate high resistance, shorts and opens.

B. Control Module Inputs, Switches and Sensors ..... 18 Hours

Outcome: Describe and test input devices.

1. Describe how and where discrete switches are used as control modules.
2. Identify types of sensor classification (inductive, resistive, etc.),
3. Describe the operation and application of commonly used sensors.
4. Describe the term "feedback loop" and how sensors are used in a feedback system.
5. Test sensors and switches according to sensor/switch type.

C. Control Module Outputs and Output Devices ..... 12 Hours

Outcome: Describe and test output devices.

1. Describe the operation and application of common output devices, including solenoids, relays, lamps and motors.
2. Describe how output devices interacting with control modules can be used to control a variety of vehicle systems.
3. Test output devices according to output type.

D. Control Modules ..... 9 Hours

Outcome: Describe the operation of automotive control modules

1. Describe the functions of a processor in an electronic control module.
2. Describe how control modules interact with inputs, outputs and other control modules to control a component, circuit or system
3. Describe the operation and applications of diodes, transistors, capacitors and inductors

E. Multiplexing and Networking ..... 6 Hours

Outcome: Describe the operation of vehicle networks.

1. Describe the purpose of the data stream.
2. Describe the function and types of multiplexing.

3. Describe how multiplex wiring is used in a vehicle network.

F. Advanced Electrical Diagrams ..... 12 Hours

Outcome: Interpret wiring diagrams and related information to evaluate advanced circuit operation.

1. Use manufacturers' wiring diagrams and related information to verify advanced circuit operation.
2. Analyze symptoms to identify circuit faults.
3. Use wiring diagram information to select test procedures to isolate circuit faults.

SECTION TWO: ..... IGNITION SYSTEMS ..... 33 HOURS

A. Ignition System Fundamentals ..... 9 Hours

Outcome: Describe the operation of an ignition system.

1. Describe the purpose, construction and operation of an ignition system and its related components.
2. State how ionization and induction apply to ignition systems.
3. Describe the operation of a basic distributor type ignition system.

B. Electronic Ignition Systems ..... 12 Hours

Outcome: Describe the operation of electronic ignition systems.

1. Describe the function of an ignition module and its related components.
2. Describe the essential wiring connections to an ignition module.
3. Describe how a computer interacts with sensors and outputs to control an ignition system.
4. Identify the sensor inputs and output devices essential to computer controlled ignition system operation.
5. Describe the operation of distributorless ignition systems.

C. Ignition System Diagnosis ..... 12 Hours

Outcome: Diagnose ignition systems.

1. Test and diagnose problems related to ignition systems and related components using scan tools, lab scopes and test equipment.
2. Diagnose ignition system problems from analysis of primary or secondary waveforms.
3. Describe the procedures for removing and installing a distributor.

SECTION THREE: ..... FUEL SYSTEMS ..... 57 HOURS

A. Fuel Properties ..... 3 Hours

Outcome: Explain fuel properties and handling practices.

1. Describe the chemical properties of gasoline and alternate fuels.
2. Compare and contrast gasoline and alternate fuel (CNG, LPG) properties.

B. Combustion and Exhaust Emissions ..... 4 Hours

Outcome: Describe the combustion process and resulting emissions.

1. Describe the combustion process.
2. Identify the regulated and non-regulated emissions resulting from combustion.
3. Describe the effect on exhaust emissions caused by altering air fuel ratio, ignition timing or engine design.

C. Fuel Tanks and Supply Systems ..... 8 Hours

Outcome: Diagnose and repair fuel tanks and supply systems.

1. Describe the purpose, construction and operation of fuel tanks, lines, filters and pumps.
2. Describe the safety devices employed in fuel supply systems.
3. Describe the operation of electric fuel pump systems using wiring diagrams.
4. Describe the purpose and operation of fuel pressure regulators and accumulators.
5. Diagnose problems related to fuel tanks and supply systems.
6. Repair fuel supply system components.

D. Fuel Injection System Fundamentals ..... 21 Hours

Outcome: Describe the operation of fuel injection systems.

1. Describe the speed density and the mass air flow methods of air measurement, and identify the fuel injection systems where each is used.
2. Describe the purpose and operation of fuel injectors.
3. Describe the purpose, construction and operation of various common air mass measuring devices.
4. Describe the purpose and operation of common methods for controlling idle speed.
5. Describe why and how throttle position is measured.
6. Describe how and why air fuel mixtures are altered for various engine-operating conditions.
7. Identify the components necessary to operate a simple computer controlled fuel injection system.
8. Describe the function, operation, advantages and disadvantages of a throttle body fuel injection system.
9. Describe the function, operation, advantages and disadvantages of a multiport fuel injection system.
10. Describe the function, operation, advantages and disadvantages of a direct fuel injection system.

E. Fuel Injection System Diagnosis and Service ..... 15 Hours

Outcome: Diagnose and repair fuel injection systems.

1. Test and diagnose problems related to gasoline fuel injection systems using scan tools, lab scopes and common test equipment.
2. Test, diagnose and service fuel injectors.
3. Identify symptoms related to vacuum leaks in fuel-injected systems.
4. Demonstrate safe practices for working with fuel injectors.

F. Alternate Fuel Systems ..... 6 Hours

Outcome: Describe the operation of alternate fuel (compressed gas) systems.

1. Describe the operation of alternate fuel (LPG, CNG) systems.

SECTION FOUR: ..... EMISSION CONTROL SYSTEMS ..... 14 HOURS

A. Exhaust Gas Recirculation Systems ..... 3 Hours

Outcome: Diagnose and repair exhaust gas recirculation systems.

1. Describe the purpose and operation of exhaust gas recirculation systems.
2. Diagnose and repair exhaust gas recirculation systems.

B. Air Injection Systems ..... 2 Hours

Outcome: Diagnose and repair air injection systems.

1. Describe the purpose and operation of air injection systems.
2. Diagnose and repair air injection systems.

C. Catalytic Converter Systems ..... 3 Hours

Outcome: Diagnose and repair catalytic converter systems.

1. Describe the purpose, construction and operation of catalytic converter systems.
2. Diagnose and repair catalytic converter systems.

D. Evaporative Emission Control Systems ..... 6 Hours

Outcome: Diagnose and repair evaporative emission control systems.

1. Describe the sources of evaporative emissions.
2. Describe the purpose and operation of evaporative emission control systems.
3. Diagnose and repair evaporative emission control systems.

SECTION FIVE: ..... ELECTRICAL SYSTEMS DIAGNOSIS ..... 73 HOURS

A. Gauges and Warning Systems ..... 6 Hours

Outcome: Diagnose and repair instrument panel circuits and warning systems.

1. Describe the operation of instrument panel gauges.
2. Describe the operation of visual and audible warning devices.
3. Diagnose and repair problems related to warning devices.

B. Lighting Systems ..... 9 Hours

Outcome: Diagnose and repair vehicle lighting systems.

1. Describe the purpose and operation of vehicle lighting systems and related components.
2. Diagnose and repair faults related to vehicle lighting systems.
3. Align headlamps.

C. Wiper and Washer Systems ..... 8 Hours

Outcome: Diagnose and repair wiper and washer systems.

1. Describe the purpose and operation of available wiper and washer systems.
2. Diagnose and repair faults related to wiper and washer systems.

D. Power Accessory Systems ..... 7 Hours

Outcome: Diagnose and repair power accessories.

1. Describe the operation of power seat adjusters, power lock systems and power windows.
2. Describe the operation of power assisted trunks and side doors.
3. Diagnose and repair problems associated with power accessories.

E. Heated Systems ..... 3 Hours

Outcome: Diagnose and repair heated systems.

1. Describe the operation and service procedures for heated glass systems.
2. Describe the operation and service procedures for heated seats and steering wheels.
3. Diagnose and repair faults related to heated components.

F. Speed Control Systems ..... 3 Hours

Outcome: Diagnose and repair vehicle speed control systems.

1. Describe the operation of vehicle speed control systems.
2. Diagnose and repair problems related to vehicle speed control systems.

G. Information and Entertainment Systems ..... 7 Hours

Outcome: Diagnose information and entertainment systems.

1. Describe the operation of information systems.
2. Describe the operation of entertainment systems.
3. Diagnose problems related to information systems.
4. Diagnose problems related to entertainment systems.

H. Safety and Security Systems ..... 6 Hours

Outcome: Diagnose factory installed vehicle safety and security systems.

1. Describe the operation of anti-theft and alarm systems.
2. Describe the operation of remote systems.
3. Diagnose problems related to factory installed safety and security systems

I. Vehicle Networks ..... 6 Hours

Outcome: Diagnose and repair vehicle networks.

1. Diagnose and repair single fault problems related to multiplex systems.

J. Anti-lock Brake Systems (ABS) ..... 6 Hours

Outcome: Diagnose problems related to anti-lock brake systems.

1. Identify basic ABS components.
2. Describe the operation of an ABS system.
3. Demonstrate a diagnostic procedure for an ABS system.

K. Occupant Restraint Systems ..... 12 Hours

Outcome: Diagnose and repair occupant restraint systems.

1. Describe the operation of active restraint systems.
2. Identify the components of an active restraint system.
3. Describe the operation of passive restraint systems.
4. Identify components of a passive restraint system.
5. Diagnose and repair passive restraint systems.

FOURTH PERIOD TECHNICAL TRAINING
AUTOMOTIVE SERVICE TECHNICIAN TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: AUTOMATIC TRANSMISSIONS AND TRANSAXLES ..... 114 HOURS

A. Automatic Transmission Fundamentals ..... 3 Hours

Outcome: Describe operating principles of an automatic transmission.

1. Describe the operating principles of an automatic transmission.

B. Planetary Gear Sets ..... 9 Hours

Outcome: Diagnose planetary gear sets.

1. Describe the purpose and function of a planetary gear set.
2. Describe the construction, parts and operating principles of a simple planetary gear set.
3. Identify the drive, driven and held members of a planetary gear set in all forward and reverse ranges.
4. Describe the construction, parts and operating principles of a compound planetary gear set.
5. Diagnose simple and compound planetary gear set failures.

C. Torque Converters ..... 6 Hours

Outcome: Diagnose torque converters.

1. Describe the purpose, parts and operation of a lock up torque converter.
2. Describe the operation of torque converter control circuits and valves.
3. Diagnose problems related to faulty torque converters, control circuits, valves and, their effects on transmission operation.

D. Oil Pumps ..... 3 Hours

Outcome: Diagnose and repair oil pumps.

1. Describe the function, parts and operation of a fixed displacement automatic transmission oil pump.
2. Describe the function, parts and operation of a variable displacement automatic transmission oil pump.
3. Diagnose problems related to faulty automatic transmission oil pumps.
4. Disassemble and reassemble an automatic transmission oil pump.

E. Clutches and Bands ..... 6 Hours

Outcome: Diagnose and repair clutches, bands and servos.

1. Describe the purpose, parts and operation of clutch assemblies, pistons and seals.
2. Describe the purpose, parts and operation of transmission bands and servo assemblies.
3. Service transmission bands and clutches.

4. Describe the symptoms of faulty clutches, bands or servos.
5. Diagnose faulty clutches, bands and servos.

F. Hydraulic Valve Fundamentals ..... 9 Hours

Outcome: Diagnose and repair hydraulic valves.

1. Describe the operation of simple types of hydraulic valves.
2. Describe the purpose and operation of a manual valve.
3. Diagnose manual valve problems.
4. Describe the purpose and operation of pressure regulating valves.
5. Describe how throttle opening and gear selection affect main line pressure.

G. Shift Valves ..... 4 Hours

Outcome: Diagnose and repair shift valves.

1. Describe the purpose, construction and operation of a shift valve.
2. Describe how various driving conditions affect the operation of a shift valve.
3. Diagnose shift valves problems and explain how the problems affect automatic transmission operation.

H. Electronically-Controlled Automatic Transmissions (Operation) ..... 12 Hours

Outcome: Explain the operation of electronically-controlled automatic transmissions.

1. Describe the operation of an electronically-controlled automatic transmission.
2. Describe the electronic controls used in an electronically-controlled automatic transmission.

I. Electronically-Controlled Automatic Transmissions (Circuits) ..... 12 Hours

Outcome: Diagnose problems related to the circuits in an electronically-controlled automatic transmission.

1. Identify basic oil circuits and use a hydraulic circuit diagram to trace the flow of oil in an electronically-controlled automatic transmission
2. Describe how one hydraulic circuit influences other hydraulic circuits.

J. Electronically-Controlled Automatic Transmissions (Diagnosis) ..... 12 Hours

Outcome: Diagnose problems related to electronically-controlled automatic transmission operation.

1. Diagnose electronically-controlled automatic transmission problems.

K. Continuously Variable Transmissions (CVTs) ..... 5 Hours

Outcome: Explain the operation of CVTs

1. Describe the operation and principles of a continuously variable transmission.
2. Describe a road test procedure for verifying operation of a CVT.

L. Automatic Transmission Testing and Adjustments ..... 12 Hours

Outcome: Test an automatic transmission.

1. Test and verify automatic transmission operation using scan tools, lab scopes and common test equipment.
2. Perform hydraulic pressure tests on an automatic transmission to diagnose failures.
3. Adjust bands and linkages on an automatic transmission.
4. Describe a road test procedure to verify automatic transmission operation.

M. Automatic Transmission Service and Repair ..... 21 Hours

Outcome: Repair automatic transmissions.

1. Describe transmission fluid flush procedures.
2. Disassemble an automatic transmission.
3. Reassemble and adjust an automatic transmission.

SECTION TWO: ..... DIESEL FUEL SYSTEMS ..... 42 HOURS

A. Electronic Diesel Fuel Injection Systems ..... 32 Hours

Outcome: Diagnose and repair electronically-controlled diesel fuel injection systems.

1. Describe the chemical and combustion characteristics of diesel fuel.
2. Describe the operation and design features of common electronically-controlled diesel fuel injection systems and related components.
3. Perform on-vehicle testing of an electronically-controlled diesel fuel injector.
4. Test intake air heater systems.
5. Test an electronically-controlled glow plug.
6. Describe maintenance procedures for electronically-controlled diesel fuel injection systems.
7. Describe diagnostic and repair procedures for electronically-controlled diesel fuel injection systems.

B. Diesel Engine Emission Controls ..... 10 Hours

Outcome: Describe diesel engine emission controls.

1. Describe the operation of exhaust gas recirculation (EGR) systems
2. Describe the operation of diesel exhaust fluid (DEF) systems.
3. Describe the operation of particulate filters.
4. Describe the operation of catalytic converters.

SECTION THREE: .HEATING VENTILATION AND AIR CONDITIONING (HVAC) SYSTEMS ..... 36 HOURS

A. HVAC Systems ..... 12 Hours

Outcome: Explain the operation of HVAC systems.

1. Identify the environmental concerns with HVAC systems.
2. Describe the principles and properties of heat.
3. Describe the properties of refrigerants and refrigerant oils.

4. Demonstrate the safety precautions when handling refrigerants and refrigerant oils.
5. Describe the function of compressors, condensers, evaporators and accumulator/dryers.
6. Describe the function of refrigerant metering devices used in HVAC systems.

B. HVAC Controls ..... 12 Hours

Outcome: Diagnose HVAC controls.

1. Identify and explain the operation of components used for temperature control and air distribution.
2. Describe how HVAC controls may be integrated with other vehicle systems.
3. Diagnose electronic HVAC controls by accessing on-board diagnostic capabilities.

C. HVAC Repair ..... 12 Hours

Outcome: Diagnose and repair HVAC systems.

1. Identify the type of refrigerant used in an HVAC system.
2. Recover, recycle and recharge HVAC systems according to legislated guidelines.
3. Repair or replace defective HVAC components.
4. Diagnose problems and outline repair procedures related to HVAC systems using common leak, pressure and temperature testing equipment.

SECTION FOUR: ..... HYBRID ELECTRIC VEHICLES (HEV) ..... 18 HOURS

A. HEV Safety Protocols ..... 6 Hours

Outcome: Describe the safety hazards associated with hybrid electric vehicles (HEV).

1. Describe the safety hazards associated with servicing and testing hybrid electric vehicles.

B. Hybrid Electric Vehicles ..... 12 Hours

Outcome: Describe the operation of a hybrid electric vehicle.

1. Identify the variety of HEV designs on the market.
2. Describe the operation of a HEV.
3. Describe the interaction between the motor/generator and the engine during:
   a) high voltage charging
   b) traction torque
   c) kinetic energy recapture (regenerative braking or engine braking)
   d) internal combustion engine starting.

SECTION FIVE: .....VEHICLE MANAGEMENT, INTEGRATION AND VEHICLE NETWORKS ..... 12 HOURS

A. Vehicle System Integration ..... 12 Hours

Outcome: Diagnose problems associated with integrated vehicle systems.

1. Describe the impact on integrated systems caused by particular faults in a system.
2. Diagnose complex (2 or more faults) problems in vehicles with integrated systems.

SECTION SIX:.....WORKPLACE COACHING SKILLS, ADVISORY NETWORK & RED SEAL STANDARDS ..... 18 HOURS

A. Workplace Coaching Skills.....4 Hours

Outcome: Use coaching skills to train apprentices.

1. Describe and demonstrate the coaching skills used for training apprentices.

B. Advisory Network .....2 Hours

Outcome: Describe the role of the Alberta Apprenticeship and Industry Training Board and the industry network committees.

1. Describe the role and purpose of the advisory network system.

C. Interprovincial Red Seal Standards Program .....12 Hours

Outcome: Use Red Seal products to prepare for an interprovincial examination.

1. Identify Red Seal products used to develop interprovincial examinations.
2. Use Red Seal products to prepare for an interprovincial examination.

Apprenticeship and Industry Training

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